APPENDIX

LC-DAD chromatograms of animal feeds sample by the HPLC method

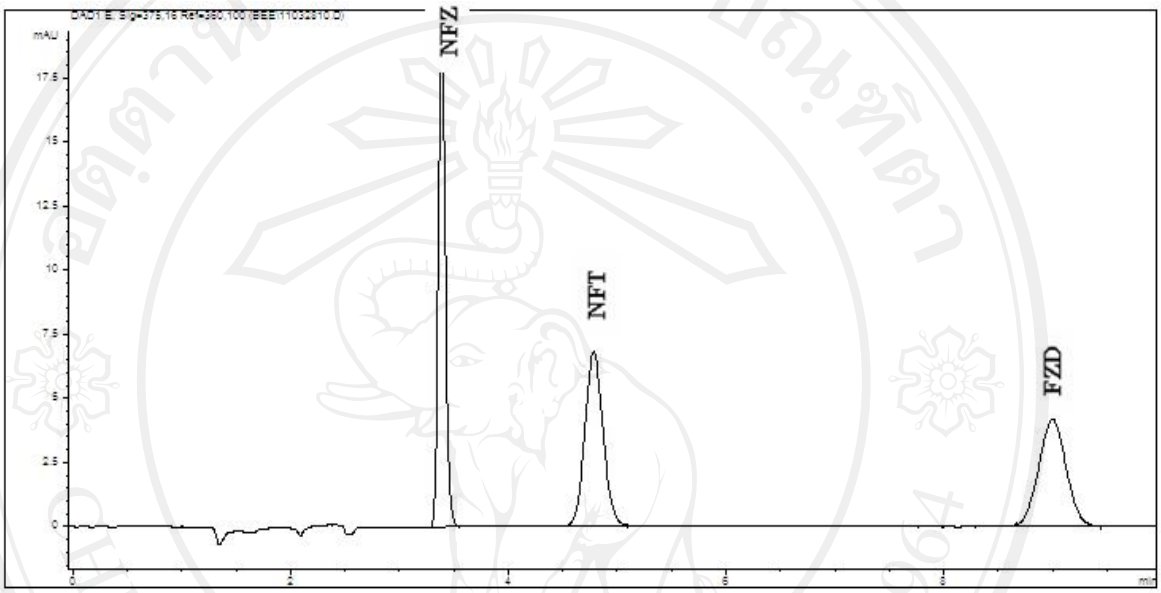

Figure 1 LC-DAD chromatograms of a mixture of nitrofuran standards at 3.0 mg L^{-1}

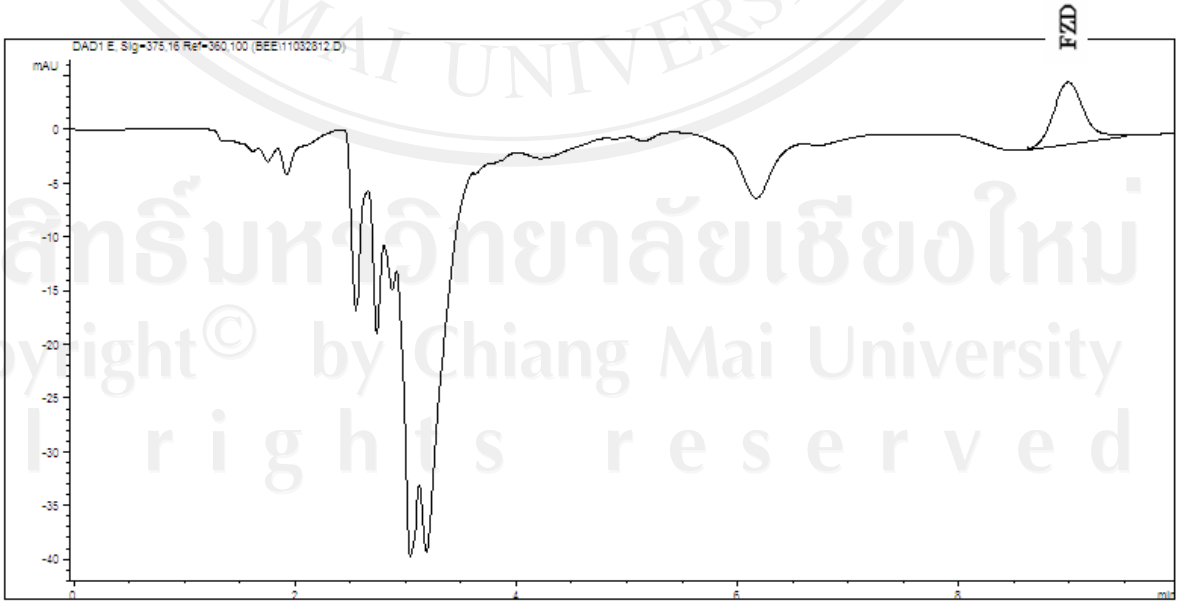

Figure 2 LC-DAD chromatograms of an animal feed A

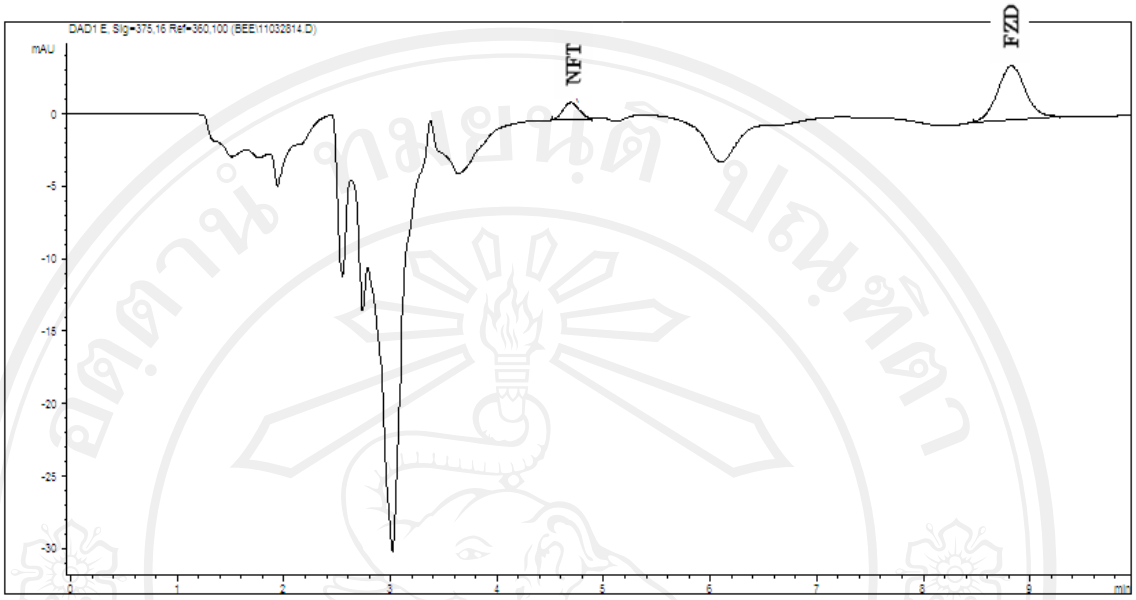

Figure 3 LC-DAD chromatograms of an animal feed B

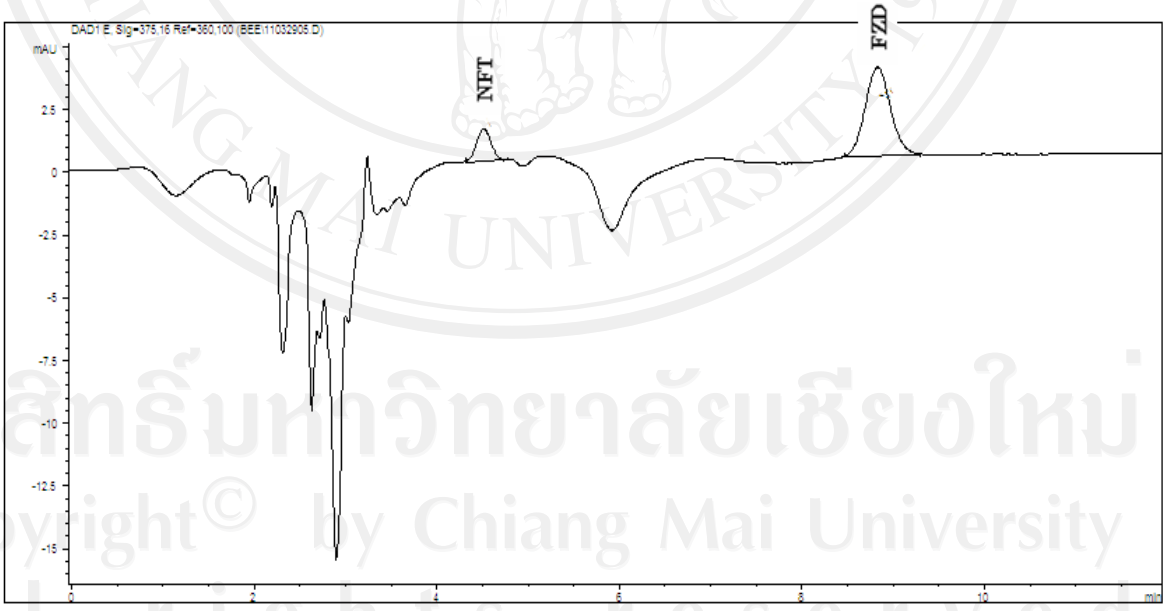

Figure 4 LC-DAD chromatograms of an animal feed C

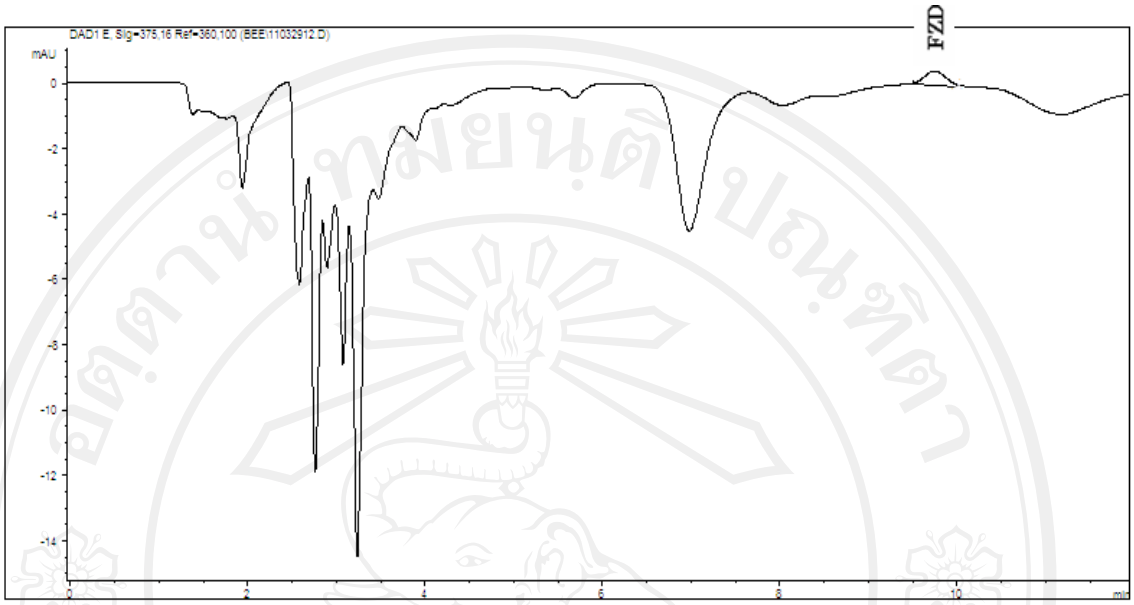

Figure 5 LC-DAD chromatograms of an animal feed D

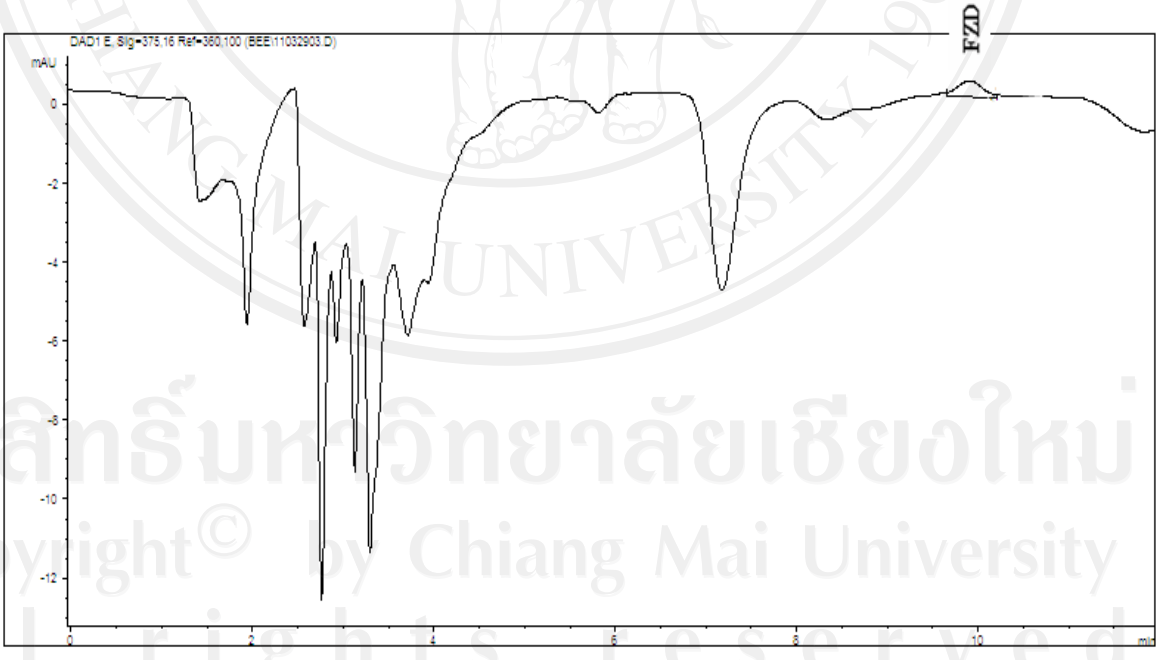

Figure 6 LC-DAD chromatograms of an animal feed E

Nitrofurans Case Study

The European Union banned the use of nitrofurans in food producing animals by classifying it in ANNEX IV (list of pharmacologically active substances for which no maximum residue limits can be fixed) of the Council Regulation 2377/90. The Food and Drug Administration (FDA) of the United States of America prohibited furaltadone since February 1985 and withdrew the approval for the other nitrofuran drugs (except some topical uses) in January 1992. The topical use of furazolidone and nitrofurazone was prohibited in 2002. Australia prohibited the use of nitrofurans in food production in late 1992. Japan did not allocate minimum required limits (MRLs) for nitrofurans leading to the implementation of a "zero tolerance or no residue standard". In Thailand, the Ministry of Health issued in 2001 Proclamation No. 231 *MRL of veterinary drug in food* which did not allocate MRL for nitrofurans. The Ministry of Agriculture and Cooperatives had already prohibited importation and use of furazolidone and nitrofurazone in animal feed in 1999 which was extended to all nitrofurans in 2002. Furazolidone and nitrofurazone were withdrawn from the list of veterinary drug formulations in 2002.

JECFA, on request from Codex, evaluated furazolidone and nitrofurazone at the 40th meeting in 1992 (WHO TRS 832 and FAO 41/5). No ADI was established for furazolidone because of its genotoxic and carcinogen, and the insufficiency of the residue data of both drugs presented. The Committee could not identify marker residues and no information was available on the quantity and nature of the total

residues. In most of the countries that recognize nitrofurans as toxic substances, the prohibition of their use in food producing animal was implemented consequently. Food containing residues of these drugs at any concentration is considered “not fit for human consumption”. Nitrofurans continue to be manufactured as drugs of choice for treatment of urinary infections in humans.

Table 1 Pharmacologically active substances for which maximum levels can be fixed

Pharmacologically active substances	**Marker residue**	**Animal species**	**MRLs**	**Target Tissues**
Furazolidone	All residues with intact 5-nitro stucture	All feed producing spicies	5 µg/kg	Muscle Liver Kidney Fat

CURRICULUM VITAE

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- High school, Samakkhi witthayakhom School, Chiang Rai, 2005
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Presentation:

- Wanida sirikeaw, Teraboon Pojanagaroon, Saisunee Liawruangrath, Tanin Tangkuaram and Sakchai Satienperakul. **A Microfluidic Device for the Determination of Selected Nitrofurans in Pharmaceutical preparations Using Chemiluminescence Detection *(poster presentation).*** Pure and Applied Chemistry International Conference 2011 (PACCON 2011), Miracle Grand Convention Hotel, Bangkok, Thailand.

THE RELEVANCE OF THE RESEARCH WORK TO THAILAND

Recently, there have been world-wide efforts to develop environmentally friendly analytical methods. An increasingly great demand for small and powerful analytical systems particularly concerns applications in field measurements of food and drug analysis. In such analytical tasks usually take up a lot of time owing to a large number of samples to be analyzed. Therefore, analytical techniques with high sample throughput and minimum consumption of reagent/sample are required.

This research work focuses on developing greener analytical method for determination of nitrofurans in real samples such as pharmaceutical preparations and animal feeds samples based on microfluidic chemiluminescene system. This method is considered as a greener analytical method and will be able to be utilized as an alternative method for determination of nitrofurans with some benefits over standard method which using toxic reagent. This system consumes little amount of reagent with minimum waste generation and also reduces cost of analytical instrumentation and sample analysis. This would be able to help the Thai Government to improve the life quality of Thai citizen and also to prevent some environmental problems of Thailand.